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ABSTRACT

This report focuses on three 11-day summer institutes on "The Impact of Toxic and Hazardous Materials on Humans and the Environment" conducted for 90 secondary school science teachers over the course of three summers at Sonoma State University, California. These summer institutes were all followed up with in-service days during the following academic year. The third year of the program targeted mentor teachers or teachers who would conduct an in-service program for their district. The theme of hazardous materials proved to be an excellent way of integrating basic science principles, recent advances in science, science and engineering technologies, and the relationship and role of science in society. Twenty-five curriculum modules/laboratory exercises were developed, field tested, and critiqued by peers. Field trips were taken to 11 sites to illustrate specific concepts or problems covered in the program. The gap between the private industrial sector and the educational sector was bridged with these numerous site visits and opportunities for interaction with experts from industry. A summary evaluation shows that all of the participants have introduced topics covered in the institute into their teaching, and 81% of their students are considering careers related to subjects covered in the institute. An institute brochure is appended. (Author/SM)

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IMPACT OF HAZARDOUS MATERIALS ON MAN AND THE ENVIRONMENT:
A SUMMER INSTITUTE WITH ACADEMIC YEAR FOLLOW-UP.

DIRECTOR: Dr. Chris K. Kjeldsen, Professor of Biology, Sonoma State University

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AASCU/ERIC Model Programs Inventory Project

The AASCU/ERIC Model Programs Inventory is a two-year project seeking to establish and test a model system for collecting and disseminating information on model programs at AASCU-member institutions--375 of the public four-year colleges and universities in the United States.

The four objectives of the project are:

- To increase the information on model programs available to all institutions through the ERIC system
- To encourage the use of the ERIC system by AASCU institutions
- To improve AASCU's ability to know about, and share information on, activities at member institutions, and
- To test a model for collaboration with ERIC that other national organizations might adopt.

The AASCU/ERIC Model Programs Inventory Project is funded with a grant from the Fund for the Improvement of Postsecondary Education to the American Association of State Colleges and Universities, in collaboration with the ERIC Clearinghouse on Higher Education at The George Washington University.

INTERIM REPORT YEAR THREE

GRANT # TEI 8650086

TITLE: Impact of Hazardous Materials on Man and the Environment: A Summer Institute with Academic Year Follow-up.

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DR. ROBERT D. RUBIN, Department of Biology, Santa Rosa Jr. College

PARTICIPANTS: 88 Secondary School Science Teachers, one Jr. High and one Elementary School Science Teacher (30 were mentor teachers who will conduct in-service workshops for their peers).

FUNDING: NSF; Hewlett Packard-$1,500; PG&E (Pacific Gas and Electric Company)-$2,000; Unocal-$2,000; Matching and In kind Support from Industry, Santa Rosa Jr. College and Sonoma State University.

ABSTRACT

Eleven day summer institutes on "The Impact of Toxic and Hazardous Materials on Humans and The Environment" were conducted for a total of 90 secondary school science teachers, 30 participants each in the summers of 1986, 1987 and 1988. These were followed up with in-service days during the following academic year (three in the first year of the program and two each for the second two years of the program). The third year of the program targeted mentor teachers or teachers who would conduct an in-service program for their district. We have found that the theme of hazardous materials is an excellent way of integrating basic science principles, recent advances in science, science and engineering technologies and the relationship and role of science in society. The program was developed based on the assumption that science teachers, for their professional effectivness, must be exposed to and understand the expansion of scientific knowledge and technology. A second assumption was that science teachers were unfamiliar with the procedures and regulations for handling and storing hazardous materials in the classroom.

The results of the program show that the subject of toxic and hazardous materials, which is of regional and national concern, is an excellent

paradigm for integrating the various disciplines of science, for addressing the advances in science and for meeting the reforms implemented in science teaching in California. The program consisted of lectures and laboratory activities conducted by the staff and curriculum module development and testing by the participants. Twenty-five curriculum modules/laboratory exercises were developed, field tested and critiqued by peers; a set of these exercises has been deposited at the Lawrence Hall of Science and they are available for other teachers. The efforts of the staff were supplemented by guest lectures and panel discussions by experts, ranging from industry representatives, to a representative from the League of Women Voters. Field trips were taken to eleven sites to illustrate specific concepts or problems covered in our program. The gap between the private industrial sector and the educational sector was bridged with these numerous site visits and opportunities for interaction with experts from industry.

Each participant received a binder prepared by the staff with selected reprints, copies of lecture handouts and suggestions for supplementary reading, curriculum modules/laboratory exercises, numerous handouts from industry representatives, and CEPUP -Lawrence Hall of Science- Laboratory modules.

PROGRAM ANALYSIS

A. Overview

The comprehensive pre-planning for the program included recognized experts from the League of Women Voters, Chevron Oil Company, Pacific Gas and Electric Company, Hewlett Packard, and Unocal, four secondary school teachers including a social science teacher, a physician and the five project staff members. The use of formative evaluations from the planning session was a major factor contributing to the comprehensiveness and success of the program. Another factor was the participant interest in the subject, the professionalism of the participants and the rapport established between the participants, staff and industry representatives. A participant wrote in a letter "the thing that really was outstanding was the camaraderie that existed throughout. I have attended many different institutes and special programs over the years and none of them developed the close associations that this program has. Of the approximately fifteen institute [at Lawrence Hall of Science] with which I was I involved as an associate director, nothing like this was ever achieved. Some of the U. C. institutes lasted for ten weeks! Even with the longer period of time we were unable to achieve what you achieved in two weeks." An unexpected benefit of the program which may in part illustrate the success of the program was that our secondary school mentor teacher, staff member Mr. William Andrews, was hired at the conclusion of our first summer institute by the California State Department of Education. He has since written and distributed to all schools in California a Science Safety Handbook. In addition he has

conducted statewide a series of seminars for science teachers on the handling and storage of hazardous materials and coordinated a statewide "toxic sweep" for the removal and disposal of hazardous materials from secondary school classrooms.

An additional factor that must be mentioned as an essential ingredient for the success of the program was the institutional support provided by Sonoma State University and the cooperation and logistical support from industry and regulatory agencies.

B. Participant Selection

Thirty participants were selected for each year of the program from applicant pools that ranged from forty-five to fifty-two applicants. All of the participants were secondary level science teachers except for one middle school teacher and an elementary school science teacher who was admitted due to a last minute cancelation.. Three-fourths of the participants were physical science teachers and one-quarter were biology teachers. Six of the participants were identified as ethnic minorities, and twenty-one of the participants were female which made a total of twenty-nine percent of the participants from groups under-represented in science teaching.

C. Evaluation

The program was a resounding success as judged by the participant formative and summary evaluations (written and oral), comments by industry facilitators and by our staff's critiques and evaluations. Part of the success is due to the subject matter which is of immediate interest, cross-disciplinary and has the advantage of a direct translantion and transfer of science to a societal problem. Another ingredient is simply the privilege of devoting unencumbered and uninterrupted time to a subject. Participants, upon completion of the program, have all said that the intensity and rigor of the program and opportunity to study without distractions were important strengths of the institute. Another recognized strength of the program was the opportunity to interact with the project staff and industry representatives and to visit places which are actually involved with the proper storage, treatment and disposal of hazardous materials or are conducting remedial projects to rectify earlier errors.

A formative evaluation (written and oral) was administered each year at the end of the summer phase of our program. We used this as a measure of the success of the program and also to develop and refine the follow-up in-service phase of our program. Our analysis of these data are that we have effectively conducted an ambitious program that has met our objectives and is on target in terms of teacher needs. The materials and concepts met the needs of the reforms implemented in science education as well as objectively meeting an issue that is of public concern. Participants have been provided with the conceptual framework,

first-hand experiences and knowledge necessary for enriching their curriculum and enhancing their effectiveness in the classroom as well as objectively understanding a complex national and international issue that extends beyond science and technology into law, economics and politics.

One point that stands out in the staff analysis and critique of the program is the sense of professionalism that the program engendered within and among the participants. One participant expressed a measure of success of the program as an " opportunity to feel like and be treated as a professional by professionals". Teachers have few occasions to interact and reflect on their profession, and programs such as this are rewarding as one witnesses the growth and sense of professionalism that develops.

A summary evaluation was administered to the participants at the end of our final follow-up session (for the third year of our program this will be conducted in March of 1989). This evaluation from the first two years shows that all of the participants have introduced topics covered in the institute into their teaching and that 81% of their students are considering careers related to subjects covered in the institute. All of the participants indicated that they have or intend to continue learning about hazardous materials. It was shown that 82% were definitely more aware of hazardous material issues in their communities. Ninety-two percent of the participants have shared the information and curriculum materials with their colleagues. All participants indicated that the institute made them more aware of the use and safety of toxic and hazardous materials in their classrooms and at home. An overall evaluation of the program by the participants indicated that 80% ranked it excellent and the remaining 20% ranked it above average.

Impact of Hazardous Materials on Humans and the Environment

A Summer Institute and
In-Service Follow-Up for
High School Science Teachers

June 19 - July 1, 1988

Sponsored by:
Sonoma State University
School of Natural Sciences
Funded by:
The National Science Foundation, with additional support from Santa Rosa Junior College, Hewlett-Packard, UNOCAL, and Pacific Gas & Electric Company.

Impact of Hazardous Materials on Humans and the Environment

A Summer Institute and In-Service Follow-Up for High School Science Teachers

Sonoma State University will conduct a Summer Institute, June 19 - July 1, 1988. In-service follow-ups are scheduled for November 12, 1988 and a Saturday in March 1989. Thirty teachers will be selected to attend.

This is the third year of our program. Based on previous participants evaluations the program has been very successful in meeting the professional needs of science teachers.

The Summer Institute and follow-up are designed to provide the scientific background and knowledge to integrate the issues relating to hazardous materials into the participants' curriculum. Participants will be provided with the conceptual framework, first-hand experience and knowledge necessary for enriching their district's curriculum. The concepts covered will facilitate secondary school educators in meeting the reforms implemented in science education as well as addressing an issue that is a regional and national concern.

Participant Support

1. Stipend of $500.00 for each participant in the course.
2. A round-trip travel allowance from the participant's home to the course at the rate of 22 cents per mile, per day (maximum of $200).
3. Subsistence (maximum of $350). Participants living at home may not receive the maximum subsistence allowance.

The amount of money awarded (support and travel allowance) will be paid in part upon completion of the Summer Institute, and part upon completion of the in-service follow-up segment of the course. **Support is dependent upon full attendance and participation.**

Description

The Summer Institute and in-service follow-up are designed to integrate basic science principles, recent advances in science, and the issues of hazardous materials which are directly applicable to the needs of science teachers. The program will consist of faculty lectures, presentations by industrial scientists, discussions, site visits, laboratory experiments and the development of techniques that will facilitate transfer to colleagues within the participant's district.

The objectives of the program are:

1) to address the issues associated with hazardous materials, their production, use, dispersal, recognition and disposal as they relate to human health, ecological systems, industrial and agricultural needs and the regulatory processes. Specific topics include:
   a) ecological principles;
   b) methods of detection, analysis and assessment of the risk of hazardous materials such as:
      - pesticides;
      - air and water pollution
      - heavy metals; and
      - nuclear materials.
   c) the physiological mechanisms for the action and degradation of hazardous materials by living organisms; and
   d) disposal technologies.
2) first-hand experiences that provide:
   a) the transfer of science and technology into society;

b) interaction with and understanding of the perspective of the private sector;
c) an understanding of the role of the various regulatory agencies;
d) a mechanism for peer exchange of techniques and experiences which are the cornerstones for professionalism in teaching; and
e) experiments that will be transferable to the classroom.

3) to foster cooperative partnerships between state and local educational institutions, citizen groups, industry, cultural institutions and governmental agencies:

4) to provide science teachers with the knowledge, techniques and methods that will allow:
   a) an understanding of the problems decision makers and managers face in the application of scientific principles and methods to the assessment of risk and regulatory responses with regard to hazardous materials;
   b) understanding the limits of science and technology; and
   c) reinforcement of the need for personal ethics as citizens.

5) to conduct follow-up sessions that stress the transfer of information to fellow teachers within each participant's school.

Credit
Two semester units of upper division credit—graded CR/NC—may be earned for the completion of the course, Biology s485. If credit is desired you must pay the summer session contract fee (tuition is waived). The course consists of an intensive 13-day program open only to students selected by the director and staff.

Eligibility
To be eligible for admission as a participant, a teacher must have a baccalaureate degree and have had at least 20 semester units of basic science courses. Applicants are expected to be designated mentor teachers or demonstrate a commitment to conducting an inservice workshop within the district, to have had a minimum of three years of high school teaching experience and demonstrate plans for continued teaching in science at that level.

Highest priority among applicants of comparable and suitable qualifications will be given to those applicants who have not previously received funding for similar programs.

In selecting individuals for participation and otherwise in the administration of the course, the director and staff will not discriminate on the grounds of race, creed, sex, color or national origin of any applicant or participant.

Program
Participants are expected to devote full time to the course. **Field trips are required** along with morning, afternoon and evening sessions which will include lectures, laboratory, field work and demonstrations.

Sonoma State University is located 45 miles north of San Francisco and provides excellent facilities for study and laboratory research.

Sonoma State University, one of the nineteen California State Universities, was created by action of the California legislature in 1960. Collectively, the nineteen campuses represent the largest system of public education in the Western Hemisphere. Sonoma State University offers a distinctive education in the liberal arts and sciences. The University's excellent academic programs, distinguished faculty, close-knit campus community and unique environment combine to give students a rich and rewarding educational experience.

The course will be conducted using the classroom and laboratory facilities of Sonoma State

University. Additional instruction will occur in the field on a series of field trips in the San Francisco Bay Area.

With cooperation from industry and regulatory agencies, the course will focus on hazardous materials and the future alternatives which are possible. The scientific-technical aspects of hazardous materials will be considered, as well as the economic-political issues associated with hazardous materials. First-hand experience will be provided by on-site field visits. Transportation for the field trips will be provided as part of the course. Because of the large size of the group, spouses and other non-members of the program may not accompany participants on the field trips.

Housing and Costs

Housing: Participants are free to choose their places of residence for the duration of the course. A list of local motels and campgrounds will be forwarded to participants.

Dormitory facilities are available at Sonoma State University. On-campus housing can be reserved by calling the Summer Conference Office, no later than June 2, 1988. Tentative rates: $185.00 per person, double occupancy room; $240.00 per person, single occupancy room. Rooms can only be reserved for the entire 11 day period. Rates include linen and towels. Summer Conference Office, Sonoma State University, 1801 East Cotati Ave., Rohnert Park, CA 94948. Telephone: (707) 664-2541.

Books: Some printed materials will be provided and participants may purchase other books and supplies. A bookstore is located on campus.

Application Deadline

Interested teachers should fill out and return the attached application form no later than May 16, 1988 to guarantee consideration. Notification of acceptance will be given by May 27, 1988 and recipients will be asked to accept or decline by May 31, 1988. Applications should be clearly identified and returned to the director as early as possible. For further information or additional application forms, write to or call:

Dr. Chris Kjeldsen, Director
School of Natural Sciences
Sonoma State University
Rohnert Park, CA 94928
(707) 664-2189

Staff

The staff is composed of faculty from Sonoma State University, Santa Rosa Junior College and Petaluma High School. Full-time instructors include Mr. William H. Andrews of the California State Department of Education and the Department of Science, Petaluma High School; Dr. Joe Brumbaugh of the Department of Biology, SSU; Dr. Vincent D. Hoagland, Jr. of the Department of Chemistry, SSU; Dr. Chris K. Kjeldsen of the Department of Biology, SSU; and Dr. Robert D. Rubin of the Department of Biology, SRJC.

In addition, a wide spectrum of lectures and discussion with authorities from industry, government and universities and colleges will be utilized to supplement the faculty members' expertise and present a balanced perspective.

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National Science Foundation
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